
स्वचल वाहन — स्थिर गति ईंधन खपत के
मूल्यांकन की पद्धति
(दूसरा पुनरीक्षण)

**Automotive Vehicles — Method of
Evaluation of Constant Speed Fuel
Consumption**
(*Second Revision*)

ICS 43.020

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भारतीय मानक ब्यूरो
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FOREWORD

This Indian Standard (Second Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Braking and Steering System, Vehicle Testing and Performance Evaluation Sectional Committee had been approved by the Transport Engineering Division Council.

This Standard was originally published in 1986 and was subsequently revised in 1993. This revision is being undertaken keeping in view the technological advancements made in the field and to align the standard with the current international practices.

In this standard SI units have been used, the unit of force, in Newton (N), of tyre load, in kilogram (kg) and of pressure, in Pascal (Pa). Their relationship are given below for information:

1 kgf	= 9.80665 N (exactly)
	= 9.81 N (approximately)
	= 10 N (within 2 percent error)
1 kPa	= 0.01 kgf/cm ² (within 2 percent error)
1 kgf/cm ²	= 98.066 kPa

NOTE — Values of kPa rounded to the nearest practical unit.

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AUTOMOTIVE VEHICLES — METHOD OF EVALUATION OF CONSTANT SPEED FUEL CONSUMPTION

(*Second Revision*)

1 SCOPE

1.1 This standard specifies the method of test for assessing fuel consumption at constant speed on a test track for all M and N category vehicles as defined in IS 14272 with gross vehicle weight (GVW) exceeding 3 500 kg.

1.2 This standard is not applicable to Hybrid electric vehicles as defined in IS 14272 as amended from time to time. Such vehicles have already been covered for fuel economy in AIS-102 (Part 2).

2 REFERENCES

The following standard contains provision, which through reference in this text constitutes provision of the standard. At the time of publication, the edition indicated were valid. All standards are subject to revision, and parties to agreements based on this standard is encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

<i>IS No.</i>	<i>Title</i>
9211 : 2003	Denomination and definitions of weights of road vehicles
14272 : 2011	Automotive vehicles — Types — Terminology

3 FEATURES OF TEST TRACK

3.1 The test track shall be straight, level paved road, covered with asphalt, concrete or similar material, dry, clean and smooth and shall have sufficient length on either side for the vehicle to attain and stabilize the test speed and also for stopping the vehicle at the end of test.

3.1.1 Where sufficient length of track is not available to conduct the test for the relevant speed, the test track having straight portion of at least 1 000 m may be used. Further, at the request of the manufacturer, a track with straight portion of less than 1 000 m length may also be used.

3.1.2 Alternately, at the request of the manufacturer, a closed-circuit track of minimum 2 000 m in length and having minimum radius of 200 m in the curved portion and suitably banked at the bends may be used. With the agreement between the manufacturer and test agency the data measured in the curved portions of the track may be omitted and only the data measured on straight portions of the track, not less than 500 m, may be used for fuel consumption determination.

3.2 The longitudinal and lateral slope of the straight portion of test track shall not be more than 0.5 percent and 2 percent respectively.

3.3 The test track shall have suitable marking to enable the driver to drive the vehicle along a straight line.

4 TEST VEHICLE SELECTIONS

4.1 Every vehicle model shall be subjected to the test. However, in case of a family of vehicles (base model and its variants), the test agencies and vehicle manufacturer shall endeavour to minimize number of variants to be tested to verify compliance of the whole family (base model and its variants), to this standard. The following criteria shall be used to select the worst case vehicle for the test in a given family (base model and its variants):

- a) Model/variant with the highest GVW within the given GVW range shall be selected.
- b) Model/variant with the highest overall ratio and/or lower tyre rolling radius which gives highest engine speed for the constant speed test, shall be selected.
- c) Model/variant with the highest frontal cross sectional area, for example, highest deck body (single deck) for buses, shall be selected. While calculating frontal cross sectional area, the height of roof mounted CNG cylinders or air conditioning equipment shall be included.

4.1.1 In case of vehicles with automated manual transmissions (AMT), at the request of the manufacturer it shall be permissible to conduct the test in the manual mode.

4.2 The fuel consumption value measured on the tested model/variant selected as per **4.1** be assigned to each variant of the vehicle models considered in selecting the vehicle in **4.1**.

4.3 As agreed between test agency and vehicle manufacturer, for the purpose of optimization of tests, the vehicle manufacturer may offer a specially configured variant to meet the requirements of worst case vehicle selection specified in **4.1**. This specially configured variant need not be otherwise type approved for production.

4.4 In the case of buses and trucks, the bus variant with fully built bus body and truck variant with cab and load body shall be used for test. If the variant list does not include such fully built version, the test may be conducted with drive away chassis versions with alternate near equivalent test cabin and test load body complying with GVW/GCW test conditions. In case of drive away chassis version of buses, the test may be conducted with the vehicle having complete body shell representing completely built vehicle for test purposes complying with GVW test conditions.

5 PREPARATION OF THE VEHICLE

5.1 The vehicle shall conform in all its parts, components and systems to the technical specifications declared by the manufacturer.

5.2 The vehicle selected for the test shall be run-in for a distance as prescribed by the manufacturer. Where no recommendation is available from manufacturer, the vehicle shall be run in for at least 500 km. Further, it may be permissible at the request of the manufacturer for the engine to be removed and run in on engine dynamometer for a duration equivalent to the run in vehicle distance prescribed by the manufacturer. At the manufacturer's request, test as per 9 can be carried out on a vehicle having odometer reading less than 100 km.

5.3 The adjustments of fuel system, ignition system, grade, quality, quantity of lubricants for various moving parts, adjustments of brake, clutch, steering, idling speed, etc., shall conform to the manufacture's recommendations.

5.4 The tyres shall be run in at the same time as the vehicle or shall have a tread depth not less than 90 percent of the tread depth of a new tyre and should have operated for atleast 500 km or the distance recommended for the running in of the vehicle, whichever is lower, on the road prior to the test.

5.5 The tyre pressure shall be adjusted to the value specified by the manufacturer, when cold, and shall not be more than the maximum value specified in the relevant Indian standard for that size of tyre.

5.6 The vehicle shall be serviced before the test as per the procedure recommended by the manufacturer.

5.7 Before the test, the vehicle including all its parts, components and systems shall have reached a stable temperature normal to the vehicle operation. The total distance of this run shall, however, be not less than 15 km and shall be carried out at a speed very close to the test speed.

5.8 Accessories

5.8.1 All power consuming accessories and equipment, such as lighting and light illuminating devices, windshield wiper and washing system, record player, air conditioner and its compressor, public information system, etc., shall be switched off. At the request of the manufacturer, test can be conducted with these equipment working. The vehicle battery shall be fully charged to minimize alternator loading.

5.8.2 In case, for reasons of safety during test, any of the lighting and light illuminating devices are to be kept operative, a separate power source shall be used, which does not impose an extra load on the engine.

5.8.3 Where the power operated or power assisted devices have an integrally connected drive for devices, such as power steering, power and vacuum assisted brakes, and similar feature required for the normal operation of the vehicle, these shall be kept operative.

5.8.4 If the radiator fan is temperature controlled (for example, viscous fan), it shall be in the condition of normal operation of the vehicle.

5.8.5 All the windows and ventilating systems and hatches of the vehicle shall be kept closed, except as required for the instrumentation purposes but such opening shall be kept to the minimum required.

6 AMBIENT CONDITIONS FOR THE TEST:

6.1 The ambient temperature shall be in the range of 10 to 40°C.

6.2 The relative humidity shall not exceed 80 percent.

6.3 Air density when calculated as described below shall not differ by more than 10 percent from the air density under the reference conditions:

$$d_t = \frac{d_0 \times P_t \times T_0}{P_0 \times T_t}$$

Where,

d_t = Air density at test site expressed, in kg/m³;

d_0 = Air density at reference conditions = 1.168 kg/m³;

P_t = Atmospheric pressure at test site, in kPa;

T_0 = Ambient temperature at reference condition = 300 K;

P_0 = Atmospheric pressure at reference condition = 100 kPa; and

T_t = Ambient temperature at test site K.

Alternatively, air density may be directly measured by any suitable device.

6.4 The wind velocity in any direction shall not exceed 3m/sec and gusts less than 5 m/s. The measurement and recording of wind velocity and direction shall be done at a height of 1 m to 2 m above the road surface.

6.5 The above measurements shall be carried out as close as possible to the test track.

7 VEHICLE LOADING

7.1 The unladen weight shall be the complete vehicle kerb weight as per IS 9211, where applicable.

7.2 Vehicle Loading

7.2.1 The vehicle shall be loaded to the gross vehicle weight (GVW) or gross combination weight (GCW) as applicable, as specified by the manufacturer and shall be recorded in the test report.

7.2.2 The weight distribution between the axles shall be as recommended by the manufacturer and weight of any axle shall not be more than the maximum value recommended by the manufacturer.

7.2.3 The instruments, the testing personnel and other equipment necessary to be carried on the test vehicle at the time of test shall form part of the payload and shall be recorded in the test report.

8 INSTRUMENTATION

8.1 General Conditions for Instrumentation

8.1.1 Fitment and operation of all instruments shall be, such as not to hamper the visibility or freedom of the driver to have proper control of the vehicle at all times. In addition, such fitment shall not unduly project out of the vehicle profile affecting the air drag or safety.

8.1.2 It must be verified that all the instruments are pre-calibrated before testing.

8.2 Vehicle Fuel

8.2.1 The test vehicle shall be filled with the corresponding commercial fuel as specified in Central Motor Vehicle Rules (CMVR) of Government of India, as amended from time to time.

8.2.2 At the request of the manufacturer, the vehicle may be instead filled with the reference fuel as specified in CMVR.

8.3 Suitable instruments to measure the following shall be used:

- a) Ambient pressure,
- b) Ambient temperature,
- c) Relative humidity, and
- d) Wind velocity.

8.4 Fuel Measuring System

8.4.1 The fuel measuring system shall be compatible with vehicle fuel system. The instrument used shall be a flowmeter working on the principle of positive displacement for sensing the flow.

8.4.2 The fitment and operation of fuel measuring system shall be such that normal flow of the fuel to the engine is not hampered. The fuel tank shall be suitably vented to the atmosphere.

In the case of gravity fed petrol engine vehicle, the pressure head at the carburetor inlet shall not be more than the head corresponding to the condition of the vehicle when the fuel tank is filled to 90 percent capacity, and also this shall not be less than that corresponding to the near empty condition of the fuel tank to the extent possible.

8.4.3 In the case of the vehicle with fuel return flow system, the return flow shall be cooled if necessary and processed so that, its temperature is very close to the temperature of the incoming fuel and is free of entrapped air or vapour bubbles.

8.5 Distance

8.5.1 The test may be conducted by the measurements being taken between two fixed points on the test track.

8.5.2 The test may be conducted by measuring the actual distance travelled by vehicle during the test run by using instruments, such as fifth wheel, contactless distance measuring systems, etc.

8.6 Speed

There shall be a suitable speed indicating device to enable the driver to maintain the speed within the stipulated limit.

8.7 Time

It shall be possible to measure the time taken for the vehicle to cover the measuring stretch.

8.8 Fuel Temperature

Fuel temperature shall be measured at a point as close to the volumetric measurement of the fuel, as possible.

8.9 Synchronization

The operation of the instruments measuring the distance, time and the fuel quantity shall be synchronized within 0.2 s.

8.10 Accuracy and Least Count

The accuracies and least counts of the instruments used shall be as under:

	<i>Least Count Not More than</i>	<i>Error Not More than</i>
i) Fuel measurement	0.1ml	± 1 percent of measured value
ii) Distance	1m	± 2 m
iii) Time	0.1 sec	± 0.2 sec
iv) Fuel temperature	1K	± 2 K
v) Ambient temperature	1K	± 2 K
vi) Atmospheric pressure	1 mm of Hg	± 1 mm of Hg

9 TEST PROCEDURE

9.1 The vehicle shall be tested at the constant speed/speeds (for example, 40 km/h, 50 km/h and 60 km/h) required for the test. Instead of required test speeds, at the request of manufacturer, test agency and vehicle manufacturer can mutually agree for a test speed which is greater than the required test speed(s) by +5 km/h. However, even at those test speeds, the vehicle shall meet the fuel consumption limits applicable to the required test speed(s).

If vehicle rated speed at laden condition is not more than 60 km/h, the vehicle may be tested at 40 km/h and shall meet the fuel consumption limits applicable to 40 km/h. If any laden vehicle could not achieve required test speed(s), tests may be undertaken at lower speed(s) stipulated in statutory rules or may be exempted from these tests.

9.2 The vehicle shall be run in top gear or in the gear as recommended by the manufacturer.

9.2.1 Vehicles fitted with overdrive transmissions where overdrive limit engages automatically, shall be driven with the actuating switch (if any) in a position which ensures engagement when conditions of operation are reached. Vehicles having gearboxes with HIGH and LOW banks of gear ratios shall be engaged in HIGH mode. Auxiliary crawler arrangements if any shall remain disengaged.

9.2.2 Vehicles with automatic transmission shall be driven in the drive ranges. If the vehicle has multiple driven rear axles, such as 6×4 and 6×2 or 8×4 and 8×2 etc., then the test shall be conducted only 6×4 or 8×4 (4 wheel drive mode) and no test shall be conducted on 6×2 or 8×2 configuration.

If vehicle has 2-wheel drive mode and 4-wheel drive mode both, the test shall be conducted only at 4-wheel drive mode and no test with 2-wheel drive.

9.2.3 Vehicles having lift axle shall be tested with the wheels of lift axle in contact with ground and in fully functional condition.

9.2.4 If the vehicle has multiple operation modes with manual switching and with different fuel efficiency performance requirements, the test shall be conducted in the default mode fixed by the manufacturer. For this, all the modes of operation shall be declared by the manufacturer in his application. At the request of the manufacturer, the tests may be conducted in all the modes of operation declared by the manufacturer.

9.3 During the test run, the speed shall be maintained within ± 1 km/h of the target speed. While maintaining this speed band, the movement of accelerator control position shall be minimized. Any unavoidable movement of the accelerator control required to hold the speed constant shall be smooth and gradual. At the request of the manufacturer, cruise control systems may be used to maintain the vehicle speed at the desired speed.

9.4 During the test, the following shall be recorded:

- Volume of fuel consumed, ml ... Q
- Distance travelled, m ... S
- Time taken to cover the test distance, seconds ... t
- Fuel temperature, K ... T_t
- Ambient temperature – Dry bulb, K ... T_{DB}
- Ambient temperature – Wet bulb, K ... T_{WB}
Ambient temperature, $T_t = (T_{DB} + T_{WB})/2$
- Ambient pressure at test site, kPa ... P_t
- Wind velocity, in m/s ... v
- Relative humidity, in percent ... H

9.5 The test shall be conducted over a distance of 1 000 m preferably. In case of the straight portion of the track being less than 1 000 m, manufacturer and test agency may agree to conduct the test over shorter lengths of the track. Two consecutive test runs in the opposite directions shall constitute a pass.

9.6 It shall be permissible for the track to have non-straight portion which are used for accelerating the vehicle to the test speed. However, the data measured in the curved portions of the track may be omitted and only the data measured on straight portions of the track, not less than 500 m, may be used for fuel consumption determination.

9.7 The test shall be conducted sufficient number of times such that the readings for at least 5 passes (one

pass comprising consecutive readings in the opposite directions), whose variation of S/Q_c for that pass is not more than ± 2.5 percent of mean and the average speed not varying by more than ± 1 km/h from the specified speed can be selected. These readings shall be selected such that the variation of S/Q_c is the minimum.

9.8 Calculation of Fuel Consumption

9.8.1 The quantity Q of fuel consumed in all passes shall be corrected to the fuel temperature from the following equation:

$$Q_c = \frac{Q}{1 + 0.001(T_f - 300)}$$

Where,

T_f = The average fuel temperature for all passes;

Q = Volume of fuel consumed for all passes, ml; and

Q_c = Corrected volume of fuel consumed for all passes, ml.

9.8.2 The fuel consumption shall be calculated in km/litre as:

$$F = \frac{S}{Q_c}$$

Fuel consumption shall also be reported in L/100 km unit (rounded up to 4 decimal places) and it shall be calculated as follows:

$$\text{Fuel consumption in } L/100km = \frac{100}{F}$$

where,

F = Fuel consumption, in km/litre;

S = total distance covered in all passes, in m; and

Q_c = total fuel consumed in all passes corrected to the fuel temperature.

9.8.3 The average speed (V) in km/h shall be calculated as:

$$V = 3.6 \times \frac{S}{t}, km/h$$

Where,

S = Distance travelled in all passes, m; and

t = Total time taken for all passes, in seconds.

10 REPORTING OF TEST RESULTS

Test report shall contain at least the information mentioned in the test report format given in Annex A. Test results in L/100 km reported shall be rounded to four places after the decimal point.

11 CRITERIA FOR EXTENSION OF TYPE APPROVAL

11.1 In case vehicle manufacturer changes technical specifications of vehicles or added variant(s), the following criteria shall be considered for deciding the extension of test / type approval.

11.1.1 In case of following changes, constant speed tests are necessary for establishing extension of type approval:

- a) Change exceeding 10 percent in the gross vehicle weight / gross combination weight;
- b) Change in the engine type, swept volume exceeding 10 percent, number and arrangement of cylinders;
- c) Change in declared engine power or torque exceeding 5 percent;
- d) Change in the fuel system such as carburetor to fuel injection or vice-versa;
- e) Change in type of transmission (manual to automatic/semiautomatic or vice versa);
- f) Change from radial ply to cross ply tyres;
- g) Change in the overall transmission ratio (in the gear used for test) and change in rolling radius of tyre, which changes the engine rpm at the test speed of exceeding 8 percent (if both parameters are changed, the combined effect on engine rpm at the test speed should be considered);
- h) Change in the No. of axles;
- j) Change in ignition/injection timing exceeding 2° ;
- k) Change in the No. of tyres;
- m) Change in body shape which increases the frontal area of vehicle that increases the road load (measured through coast down test) at the test speed by more than 10 percent;
- n) Change in the air intake system (naturally aspirated to supercharged /turbocharged or vice versa); and
- p) Changes in the Engine Control Unit (ECU), including calibration.

11.1.2 In case of changes other than those listed in **11.1.1**, constant speed tests shall not be repeated for establishing the extension of type approval.

11.2 In case of changes in technical specifications listed in **11.1.1**, at the request of manufacturer, the test agency may use computer simulation tools to get the fuel consumption values for those vehicles with changed specifications. Test agencies may use well established simulation tools from the market or may develop a new simulation tool to suit Indian conditions. The validation of simulation tool for the variants is to be established with the right degree of correlation with physical tests.

ANNEX A

(Clause 10)

SAMPLE TEST REPORT FORMAT**A-1 VEHICLE CONFIGURATION DETAILS****A-1.1 Vehicle Model****A-1.2 GVW / GCW (kg)****A-1.3 Number of Axles****A-1.4 Vehicle Frontal Cross Sectional Area****A-1.5 Gearbox****A-1.5.1 Type****A-1.5.2 Make****A-1.5.3 Model****A-1.5.4 Gear used for test****A-1.6 Tested Gear ratio and Gear Box Model****A-1.7 Engine****A-1.7.1 Mode of Operation:** (*Eco/Power/Automatic/Any other*)**A-1.8 Max. Engine power, kW @ rpm****A-1.9 Cold Tyre Pressure(kg/cm²/psi/kPa)**

a) Front, or

b) Rear

A-1.10 Available Average Tyre Thread Depth for Test (in mm)**A-1.11 Fuel****A-1.12 Fuel Specific Gravity****A-2 ATMOSPHERIC CONDITIONS****A-2.1 Wind Velocity (m/s)****A-2.2 Relative Humidity (Percent)****A-3 TEST SITE****A-4 ROAD SURFACE****A-5 TEST RESULTS FOR TEST SPEED X KM/H**

Sl No.	Nominal Speed, km/h	One Side				Opposite Side				S/Q _c	Variation in S/Q _c
		Fuel Consumed, ml (Observed)	Time Taken, Seconds (Observed)	Fuel Temperature, °C	Fuel Consumed, ml (Corrected) Q _c	Fuel Consumed, ml (Observed)	Time Taken, seconds (Observed)	Fuel Temperature, °C	Fuel Consumed, ml (Corrected) Q _c		
1											
Mean S/Q _c											
Measuring stretch /pass distance, m (M)				Total length of passes S = M × No. of passes							
Σ Time, seconds				Σ Fuel consumed, cc							
Average speed, km/h				Fuel consumption, km/l							
				Fuel consumption, L/100 km							

ANNEX B*(Foreword)***COMMITTEE COMPOSITION**

Automotive Braking Systems, Vehicle Testing and Performance Evaluation Sectional Committee, TED 04

<i>Organization</i>	<i>Representative(s)</i>
National Automotive Testing and R&D Infrastructure Project (NATRAX), Indore	DR N. KARUPPAIAH (Chairman)
Ashok Leyland Ltd, Chennai	SHRI D. BALAKRISHNAN SHRI VED PRAKASH GAUTAM (<i>Alternate</i>)
Association of State Road Transport Undertakings, New Delhi	DR M. TRINATH BABU SHRI S. D SAROLE (<i>Alternate</i>)
Automotive Component Manufacturers Association of India, New Delhi	SHRI UDAY HARITE SMT SEEMA BABBAL(<i>Alternate</i>)
Automotive Research Association of India, Pune	SHRI A. AKBAR BADUSHA SHRI P. D. BETGERI (<i>Alternate</i>)
Bajaj Auto Ltd, Pune	SHRI R. NARASIMHAN SHRI ARVIND KUMBHAR (<i>Alternate</i>)
Bosch Chassis Systems India Limited, Pune	SHRI SUHAS S. PATIL SHRI MILIND KULKARNI (<i>Alternate</i>)
Brakes India Pvt Ltd, Chennai	SHRI P. VENUGOPAL SHRI S. SHEKHAR (<i>Alternate</i>)
Central Farm Machine Training & Testing Institute, Budni	SHRI J. J. R. NARWARE SHRI C. V. CHIMOTE (<i>Alternate</i>) SHRI PRAMOD YADAV (<i>Young Professional</i>)
Central Institute of Road Transport, Pune	SHRI S. N. DHOLE SHRI SANTOSH GUTTE (<i>Alternate</i>) SHRI D. H. PENDHARKAR (<i>Young Professional</i>)
Central Road Research Institute, New Delhi	SHRI P. V. PRADEEP KUMAR SHRI SUDESH KUMAR (<i>Alternate</i>)
Continental Automotive Components (India) Pvt Ltd, Manesar, Gurugram	SHRI RAHUL MARE SHRI RAGHAVENDRA HARIHARAN (<i>Alternate</i>)
Daimler India Commercial Vehicles (P) Ltd, Chennai	SHRI SUDERSON S. V. SHRI PRABHU R. (<i>Alternate</i>) SHRI ANTONY KURIAN (<i>Young Professional</i>)
Denso International India Pvt Ltd, Manesar, Gurugram	SHRI NOEL ALEXANDER PETERS SHRI ALOK KUMAR (<i>Alternate</i>) MS ALKA SHARMA (<i>Young Professional</i>)
Force Motors Ltd, Pune	SHRI ANIRUDDHA KULKARNI SHRI R. M. KANITKAR (<i>Alternate</i>)
Federal Mogul VSP (India) Ltd, Kancheepuram, Tamil Nadu	SHRI VENKATESH SANKARAN SHRI R. VENKAT (<i>Alternate</i>)
General Motors India (P) Ltd, Pune	SHRI A. TAJUDEEN
Global Automotive Research Centre, Chennai	SHRI M. V. RAMACHANDRAN SHRI S. PERUMAL (<i>Alternate I</i>) MOHAMMAD SUHAIL (<i>Alternate II</i>)

<i>Organization</i>	<i>Representative(s)</i>
Hero Motocorp Ltd, Dharuhera	SHRI FEROZ ALI KHAN SHRI PIYUSH CHOWDHRY (<i>Alternate</i>) MOHAMMAD DANISH GAZALI (<i>Young Professional</i>)
Honda Motorcycle and Scooter India Pvt Ltd, Gurugram	SHRI SURAJ AGARWAL SHRI VIPIN SHARMA (<i>Alternate</i>)
ICAT, Manesar	SHRI GAVENDRA SINGH SMT VIJAYANTA AHUJA (<i>Alternate</i>)
Indian Institute of Petroleum, Dehradun	SHRI M. K. SHUKLA SHRI SUNIL PATHAK (<i>Alternate</i>)
Knorr-Bremse Systems for Commercial Vehicles India Pvt Ltd, Pune	SHRI ARUN BISHT
Mahindra & Mahindra Ltd, Nasik	SHRI S. RAGHUPATHI SHRI DEVINDER TANGRI (<i>Alternate</i>) SHRI ARUN KUMAR PRASAD (<i>Young Professional</i>)
Mahindra Trucks & Buses Ltd, Pune	SHRI V. G. KULKARNI
Maruti Suzuki India Ltd, Gurgaon	SHRI VIVEK TRIVEDI SHRI GURURAJ RAVI (<i>Alternate</i>) SHRI RAJ KUMAR DWIWEDI (<i>Young Professional</i>)
Department of Heavy Industries, New Delhi	SHRI R. K. JAISWAL
NATRIP, Indore	DR P. P. CHATTARAJ SHRI SAGAR BENDRE (<i>Alternate</i>)
Ordinance Factory Board, Jabalpur DGQA	SHRI UMESH KUMAR SHRI VIKASPURWAR (<i>Alternate</i>) COL RAJEEV CHAWLA (<i>Young Professional</i>)
PCA Motors Pvt Ltd, Chennai	SHRI SUDHIR DESHPANDE
Rane TRW Steering Systems Ltd, Trichy	SHRI R. M. THIRUPATHI SHRI K. V. BANUPRASATH (<i>Alternate</i>)
Renault Nissan Tech & Business Centre, Chennai	SHRI N. BALASUBRAMANIAN SHRI K. THANGARAJ (<i>Alternate</i>)
Representing Ministry of Road Transport & Highways, New Delhi	DIRECTOR (<i>Technical</i>)
Society of Indian Automobile Mfrs, New Delhi	SHRI P. K. BANERJEE SHRI AMIT KUMAR (<i>Alternate</i>)
Sundaram Brake Linings Ltd, Chennai	DR J. GOPALAKRISHNAN SHRI R. BALASUBRAMANIAN (<i>Alternate</i>)
SML Isuzu Ltd (Swaraj Mazda), Ropar	SHRI SANDEEP AGARWAL SHRI MOHIT GUPTA (<i>Alternate</i>) SHRI ABHINAV SHARMA (<i>Young Professional</i>)
Tata Motors Limited, Pune	SHRI P. GOWRISHANKAR SHRI UDAY SALUNKHE (<i>Alternate</i>)
Toyota Kirloskar Motors Pvt Ltd, Bangalore	SHRI REVADI CHANNAPPA SHRI RAJU M. (<i>Alternate</i>)
Tractor Manufacturers Association, New Delhi	SHRI S. LAKSHMIPATHY SHRI K. KANNIBARAN (<i>Alternate</i>)
TVS Motor Co Ltd, Hosur	SHRI M. S. ANAND KUMAR SHRI R. NAGARAJAN (<i>Alternate</i>)

<i>Organization</i>	<i>Representative(s)</i>
Vehicles Research & Development Establishment, Ahmednagar	SHRI VINOD KUMAR SHRI SAM SHAIKH (<i>Alternate</i>)
VE Commercial Vehicles, Pithampur	SHRI SHYAM BUTE SHRI MOHAN KUMAR MUTHUSAMY (<i>Alternate</i>)
Volvo Buses India (P) Ltd, Bangalore	SHRI PRAMOD KUMAR HUGAR SHRI ATUL KUMAR KATTI (<i>Alternate</i>)
Wabco India Ltd, Chennai	SHRI S. V. DESHMUKH SHRI PRABHAKARAN DURAIRAJ (<i>Alternate</i>)
ZF Steering Gear India Ltd, Pune	SHRI CHANDRAKANT K. DANGE SHRI SAMSON BORDE (<i>Alternate</i>)
Panel	SHRI S. RAVISHANKAR
BIS Directorate General	SHRI R. R. SINGH, SCIENTIST 'E' AND HEAD (TED) [REPRESENTING DIRECTOR GENERAL (<i>Ex-officio</i>)] (<i>Member Secretary</i>)

Bureau of Indian Standards

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